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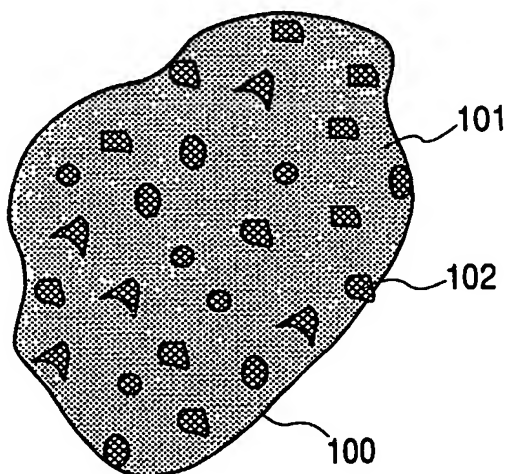
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(54) Title: ELECTRODE MATERIAL FOR LITHIUM SECONDARY BATTERY AND ELECTRODE STRUCTURE HAVING THE ELECTRODE MATERIAL



(57) Abstract: The electrode material for a lithium secondary battery according to the present invention includes particles of a solid state alloy having silicon as a main component, wherein the particles of the solid state alloy have a microcrystal or amorphous material including an element other than silicon, dispersed in microcrystalline silicon or amorphized silicon. The solid state alloy preferably contains a pure metal or a solid solution. The composition of the alloy preferably has an element composition in which the alloy is completely mixed in a melted liquid state, whereby the alloy has a single phase in a melted liquid state without pressure of two or more phases. The element composition can be determined by the kind of elements constituting the alloy and an atomic ratio of the elements.

AMENDED CLAIMS

[received by the International Bureau on 14 September 2004 (14.09.04);
original claim 1, 10 and 15 amended; original claims 2 cancelled; remaining claims unchanged]

1. (Amended) An electrode material for a
lithium secondary battery, comprising particles of a
5 solid state alloy having silicon as a main component,
wherein the particles of the solid state alloy have a
microcrystal or amorphous material comprising an
element other than silicon, dispersed in
microcrystalline silicon or amorphized silicon, and
10 wherein the solid state alloy contains a pure metal
or a solid solution.

2. (Cancelled)

3. The electrode material for a lithium
secondary battery according to claim 1, wherein the
15 alloy has an element composition in which the alloy
is completely mixed in a melted liquid state.

4. The electrode material for a lithium
secondary battery according to claim 1, wherein the
alloy is composed of silicon and at least a first
20 element A having a lower atomic ratio than silicon,
and wherein the first element A is at least one
element selected from the group consisting of tin,
indium, gallium, copper, aluminum, silver, zinc and
titanium.

25 5. The electrode material for a lithium
secondary battery according to claim 1, wherein the

the second element E being at least one element selected from the group consisting of copper, silver, zinc, titanium, aluminum, vanadium, yttrium, zirconium and boron;

5 (c) a eutectic of the first element A and the second element E, the first element and the second element being different from each other;

(d) a eutectic of any combination of (a), (b), and (c).

10 9. The electrode material for a lithium secondary battery according to claim 1, wherein the silicon in the alloy is doped with at least one element selected from the group consisting of boron, aluminum, gallium, antimony and phosphorous at a
15 dopant amount of an atomic ratio in a range of 1×10^{-8} to 2×10^{-1} with respect to the silicon.

10. (Amended) An electrode material for a lithium secondary battery, comprising silicon particles having silicon as a main component, wherein
20 the silicon is doped with at least one element selected from the group consisting of boron, aluminum, gallium, antimony and phosphorous at a dopant amount of an atomic ratio in a range of 1×10^{-8} to 2×10^{-1} with respect to the silicon, and wherein the
25 particles having silicon as a main component are complexed with at least a material selected from the group consisting of a carbonaceous material and metal

magnesium.

11. The electrode material for a lithium secondary battery according to claim 9 or 10, wherein the dopant has an atomic ratio in a range of 1×10^{-5}

to 1×10^{-1} with respect to the silicon.

12. The electrode material for a lithium secondary battery according to claim 9 or 10, wherein the dopant is boron.

5 13. The electrode material for a lithium secondary battery according to claim 1 or 10, wherein the particles of the alloy having silicon as a main component or the particles having silicon as a main component have an average particle diameter of 0.02
10 μm to 5 μm .

14. The electrode material for a lithium secondary battery according to claim 1 or 10, wherein the particles of the alloy having silicon as a main component or the particles having silicon as a main
15 component has a form of fine powder.

15. (Amended) The electrode material for a lithium secondary battery according to claim 1, wherein the particles of the alloy having silicon as a main component are complexed with at least a
20 material selected from the group consisting of a carbonaceous material and metal magnesium.

16. An electrode structure comprising an electrode material according to claim 1 or 10, a conductive auxiliary material, a binder and a current
25 collector.

17. The electrode structure according to claim